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# Commercialization of Genetically modified crops for improving quality and nutritional values for insufficient food shortages in India

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## Abstract

Humongous GM crop farming has resulted from the advent of biotech crops that express a number of unique features, including herbicide resistance, pest resistance, crop protection, increased nutritional content, etc. Cultivar, corn, cottonseed, cotton, corn oil, rice, rutabaga, pumpkin, fruit, and papaya are among the Gmo that have recently been commercialised in the the last twenty years. However, due to their widespread cultivation and role in the agricultural economies of many nations, rapeseed, corn, textiles, and rapeseed oil are of particular significance. The cultivation of GM foods yields significant social, commercial, and environmental benefits around the globe, although many landowners and citizens in various nations are sceptics of GMOs. Most debates about biotech plants centre on their effects and results, whether they involve farms, the environment, human health or financial outlook. This study's primary goal is to convey the idea of using genetic modification to increase agricultural yield and quality and to commercialise those improvements**.** GM foods could be used to fight insufficient food shortages does not just mean that they can be used to make food due to their own higher nutritional and yields quality, and also because they are more resistant to different kinds of stresses. The well-known GTAP (Global Trade Analysis Project) modelling methodology, which has been used to evaluate the effect of adopting GM crops in Indian agriculture. The present situation involves India adopting GM rice instead of GM cotton, corn and soybeans Given that rice is India's primary food crop, two distinct rates of 50% and 80% of adoption are taken into consideration. 50 percent adoption rate and a 10% productivity shock

will cause the price of the supply to drop, increasing the sector's production of rice. Commercial GM crop usage dates back more than ten years. Most of the GM crops used thus far have been pest and HT resistant. Existing impact studies demonstrate that these crops are advantageous to farmers and consumers and result in significant overall welfare increases. Additionally, GM crops have positive effects on the environment and human health. Due to the scale neutrality of such seed technology, GM crops may also be an excellent choice for small-scale farmers. Empirical research demonstrates that GE crops in particular may significantly increase income and alleviate poverty.

**Keywords: Genetically modified crops, Global trade analysis model, Commercialization**

## Introduction

Comparing to merely 51 million metric tons in 1950, Today's output of food grains climbed to 241 metric tons in 2010–2011. (Parwez, 2013). Nearly 70% of the entire population of India depends on the farming sector for both industry and sustenance, yet despite all of this successes, the conditions of farmers remain appalling. The plot of Gm crops makers is not as positive as some astrophysicists have claimed, and since there is not yet conclusive proof that GM crops can fertilize crops, there isn't any pressing need to move forward with their commercial production in India. Instead, new policies must be developed to ensure food protection in the future without adversely affecting its safety of people and farmed animals well being or the rich biodiversity (Chaturvedi, 2012). Promoters and several experts who support the commercialization of GM crops often emphasise this point. There is a significant divide between farmers, biologists, and authorities in India as shown by the fact that transgenic Bt cotton was sold in 2002, a ban on Bt cultivars in 2010, and several GM crops still being grown in labs or confined facilities (Shukla et al., 2018). Farmers that plant Bt cotton have benefited greatly, and their macroeconomic circumstances have improved (Lucht, 2015). According to estimates, in the 2012 growing season, 7.2 million farmers planted Gm crops on 10.8 million hectares, or 93% of India's total 11.6 thousand hectares of fiber (Stone, 2012). Despite 13 years under deregulated and the industrial sale of Btbt silk, around 40 billion bags of silk were harvested there in 2014, becoming

India the 's greatest wheat grower (Choudhary and Gaur, 2015). The current Indian administration is trying to reverse its position on GM test procedure, and just last week it approved for the experimental verification of a small number of GM crops. However, numerous State legislatures are still hesitant to adopt this innovation (Kumar, 2015). The major goal of this study is to clarify the idea of looking into genetically modified for raising agriculture yield and quantity.GM crops are the best suitable options which could be used to fight insufficient food shortages does not just mean that they can be used to make food due to their own highernutritional and yieldsquality, and also because they are more resistant to different kinds ofstresses.

## Material and method

### Study design,

The conceptual framework within which the research will be conducted is known as the research design. It is the design of conditions for data collection and analysis that attempt to balance research objective relevance with procedural economy. It provides the framework for data collection, measurement, and analysis. After collecting the data, data will investigate and conduct a descriptive research.

**Data collection** It is comprised of previously utilised information. Within the corporation, the researcher has access to a number of sources, both internal and external to the organisation. The following are secondary data sources from within the organisation:

- Documentation on the organization's health and safety procedures
- Statements of mission and vision formulation
- Magazines including Financial Statements Publications
- Executive Summary of Sales Report Customer Relationship Management Software
- Information collected from secondary sources in other locations:

- Government documents
- Publications
- Business journals
- Libraries/Internet

On the other hand, the reliability of information produced using secondary data gathering methods cannot be validated.

**Database analysis**

The renowned Global Economic Analyse Projects (GTAP) modelling methodology, which has been used to evaluate the effect of adopting GM crops in Indian agriculture. The model is run using the popular GEMPACK software programme, which was created by Australia's Mcgill University. Based off conservative monetary theory, this same GTAP framework is a statically, estimated rational expectations simulation with many sectors and areas. As a result, markets are completely competitive, and businesses who want to maximise their profits deploy technology that consistently improves with size. Similar to any other general equilibrium model, GTAP offers comprehensive information onthe internal and external links between these markets inside this star's chosen nations and areas, together with the protections, shipping, and bilateral commerce in between nations and territories. The structure of GTAP has been amended to include the labelling expenses spent according to the sector, which uses the ith item as a transitory resource. The database utilised here is version 7 (Corong et al., 2017), with a base year of 2004 and 113 countries/regions and 57 sectors. 13 regions and 14 sectors have been combined in this database for the time being. The primary GM potential crops and the industries involved in their processing were taken into consideration while creating the sectoral aggregate.

## Result and Discussion

### Commercialization of GM cotton in India

India is the world's biggest cotton grower in the world. 2 million areas of Annual crops, to ISAAA were planted in India in 2008 by 5 million small farmers, or 82 percent of the country's total adoption rate. As a result, we have contrasted two potential adoption rates for Bt cotton in this scenario—50% and 80%—with only a silk sector has long shock of 10% that is Inbred hillbillies. A 10% reduction in the wool industry's business production expense will also mean an impact on the textile industry. Table 4.2 and Table 4.2(a) indicate the consequences of Bt cotton adoption on the cotton and textile industries in India, with adoption rates of 50% and 80%, respectively. When GM fabric is used, production increases, which again is paralleled by a drop in best deals and discounts. Additionally, exports are rising. With a lower adoption rate of 50%, exports in the cotton sector rise and those in the textile sector. An increased usage rate over 80%indicates that the two industries in question will likely see increases in export. Consequently, when adoption rates rise, so do exports to a greater degree. In this case, it's important to notice that such increase in household need may not have been proportionate to the rise in flow rate. If Bangladesh switches to Annual crops at greater rate, imports would be much lower. It is clear that the trade balance will improve as exports increase and imports decrease. Contrary to the cotton industry, it has improved more in the textile sector. A rate of 80 percent adoption will further enhance the trade balance (see Table 2(a)).

**Table 2(a) Sectoral implications of Bt Cotton adoption in India at 50% adoption rate (in percent change form)**

| Sector | Supply Price | Output | Consumer demand | Export(fob) | Import(cif) | Trade Balance (million USD) |
|---|---|---|---|---|---|---|
| Textile | -0.5 | 1.22 | 0.22 | 3.38 | -1.57 | 550.4 |
| Cotton | -4.66 | 2.54 | 1.93 | 18.55 | -9.24 | 52.45 |

**Table 2(b): Sectoral implications of Bt Cotton adoption in India at an adoption rate of 80% (in percent change form)**

| Sector | Supply Price | Output | Consumer demand | Export(fob) | Import(cif) | Trade Balance (million USD) |
|---|---|---|---|---|---|---|
| Textile | -0.54 | 2.22 | 0.62 | 4.38 | -1.57 | 850.4 |
| Cotton | -5.66 | 3.54 | 2.93 | 30.55 | -15.24 | 97.45 |

**Corporatisation of GM jute, soybeans, and cornmeal in Kerala**

This scenario takes into account India's adoption of GM cotton as well as GM soybean and maize. When there is a 10% Hicks neutral productivity shock in these two industries, with a 50% adoption rate, production grows (Tables 3 a and b). When adoption reaches 80%, these industries' production rises. In contrast, the supply price is lower in the two, which causes a rise in consumer demand. Supply prices in the maize and soybean sectors decline for greater adoption rates, which results in an increase in consumer demand of 0.19 percent and 0.31 percent, respectively. According to a 2009 study by the Associated Chambers of Commerce and Industry of India (ASSOCHAM), the chicken industry consumes 51 percent of all maize used in India, while just 26 percent is utilised for human consumption (Chennakrishnan, 2012). Since consumer demand for maize is not increasing quickly, the situation is anticipated to become better with greater adoption rates (Kumar et al., 2014).

**Table 3(a)The consequences of India's deployment of GM silk, soya, and cloth at a rate approaching 50% on the grain and soya fields (in gross margin form).**

| Sector | Supply Price | Output | Consumer demand | Export(fob) | Import(cif) | Trade Balance (million USD) |
|---|---|---|---|---|---|---|
| **Maize** | -0.58 | 0.1 | 0.15 | 2.99 | -0.58 | 1.55 |
| **Soyabean** | -2.25 | 0.4 | 0.44 | 0.29 | -3.33 | 13.55 |

**Table 3(b) Implications of India's implementation of GM rice and GM soya at a level of 80% on the cornfield and soybeans industries (in total average form)**

| Sector | Supply Price | Output | Consumer demand | Export(fob) | Import(cif) | Trade Balance (million USD) |
|---|---|---|---|---|---|---|
| **Maize** | -0.55 | 0.56 | 0.25 | 0.29 | -0.97 | 2.76 |
| **Soyabean** | -1.52 | 0.94 | 0.45 | 0.51 | -5.09 | 25.44 |

**4.3.3 India adopts GM rice, along with GM cotton, maize, and soybean, with a 10% productivity shock and a 50% adoption rate.**

The present situation involves India adopting GM rice instead of GM cotton, corn and soybeans Given that rice is India's primary food crop, two distinct rates of 50% and 80% of adoption are taken into consideration. 50 percent adoption rate and a 10% productivity shock will cause the price of the supply to drop, increasing the sector's production of rice. It will result in a surge in customer demand. But the increase in demand could not match the increase in production, leading to resulting in a rise in export. The trade balance improves with a decrease in imports. Even if the magnitudes are less, the direction of change is the same with a greater adoption rate of 80%. higher. Table 4.4 shows the results for adoption rates that are lower and greater.

**Table 4: Effects of GM rice in India on the rice industry, expressed as a percent change**

| Sector | Adoption Rate | Supply Price | Output | Consumer Demand | Export(fob) | Import(cif) | Trade Balance (Million USD) |
|---|---|---|---|---|---|---|---|
| **Rice** | 50% | -6.45 | 1.08 | 0.77 | 46.25 | -31.6 | 51.26 |
| | 80% | -10.32 | 1.74 | 1.24 | 74 | -50.56 | 82.01 |

**Conclusion:**

Commercial GM crop usage dates back more than ten years. Most of the GM crops used thus far have been pest and HT resistant. Existing influence research suggests how these foods benefit both farmers and customers and boost overall wellbeing significantly. Furthermore, Transgenic crops benefit both the environment and public health.Due to the scale neutrality of such seed technology, GM crops may also be an excellent choice for small-scale farmers. Empirical research demonstrates that GE crops in particular may significantly increase income and alleviate poverty. Because of less robust IPR protection and hence cheaper seed costs, farmers in underdeveloped nations can see more benefits than farmers in wealthy nations. The larger institutional environment, which includes farmers' access to adequate seed types, loans, knowledge, and other input and output markets, also has an impact on income distribution effects. To fully realise the advantages for the poor on a bigger scale, more institutional and governmental assistance will be required. Crops that are resistant to abiotic stressors and crops that have more nutrients than conventional crops are two examples of GM technologies that are presently in the research pipeline. Such applications may have advantages that are much bigger than those that have hitherto been shown. In light of a depleting natural resource base and rising demand for agricultural goods, GM crops might make a substantial contribution to global food

security and sustainable development. For the required production increases, new technologies are essential.

Thus, it can be argued that achieving food security for the current and future generations may be accomplished via the sustainable integration of traditional agricultural techniques with contemporary biotechnology. However, it is crucial that the performance of a GM crop undergoes thorough bio-safety studies on a case-by-case basis and is rigorously monitored for multiple generations under field circumstances before being approved for commercial production. In order to maximise the potential of biotechnology for the benefit of humanity, GM crops must become an integral part of the daily lives.

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